Assembly sequence of the LCGT Standard Filter prototype.

The mechanical drawings of the LCGT standard filter prototype can be found in
JGW-D1000273-v1
with updates in JGW-D1000273-v2
and “as built” redlines in JGW-D1100352-v1

This document is intended as an illustration of the procedure required to assemble a Standard filter.
Note, this assembly comprises only 4 blades, and is a dirty assembly, just a dry run to verify the quality of the filter’s design. An operational filter would comprise up to 12 blades, with blade number and width tuned for the required payload.
Clean assembly for use in LCGT will have to be performed in a clean room, with UHV cleaned parts pre-baked at 200oC in clean air flow.
The finished filter must be tuned to the required working frequency, in clean room conditions.
Each assembled filter must then be baked in clean air at 140oC for three days before packaging, sealing and shipping.

The sequence described here is only indicative, it is intended for information of the companies bidding for the production and assembly of the LCGT filters..

The prototype was built by G&M, which is the same company that built the Virgo SA, LIGO HAM SAS, and the AEI SAS.

Introduction:

All parts must be machined with water soluble lubricants, exempt from sulfur and other chemicals that may be difficult to wash out and may outgas, impeding UHV operation (see figure 1).

Weldments must be manufactured free of cavities that may trap dirt, that cannot be properly cleaned. Shown in figure 2 is a test welding, cut out to verify the quality of the weld.

All weldments shall be electropolished and inspected for flaws before machining, then re-inspected and re-washed after machining.

Figure 1: Machining of the standard filter base plate with water-soluble coolant/lubricant, and the finished product.

Figure 2: Test weldment of standard filter outer shell, with cutouts to inspect weld quality, which must be free of cavities.

Figure 3: Standard filter parts ready for assembly: Top: base plate with keystone holding tool, Bottom blades in clamp. Frequency tuning horseshoe, blade with pulling tool, bending arch and clamps.

Figure 4: Above, blades, blade clamp with pre-stressing transport arch, and a blade with the bending pulling handle with homo-kinetic joint. Below blade clamped with transport arch bolted to the blade clamp.

Figure 5: Above: pulling handle on blade and retaining holder fixture.
Below: bending/pulling fixture with blade clamp being mounted on holder fixture.

Figure 6: Top, relaxed blade and bending arch being mounted on blade's clamp. Bottom pulling handle being mounted on tip of blade.
Tanzir Fall Madieye is performing the assembly, he is the proposed chief of assembly, he has already assisted the clean assembly of the HAM SAS for LIGO.

Figure 7: Top, pre-stressing the blade and hooking the pulling handle to its stop. Bottom transferring the load to a holding fixture.

Figure 8: Top to bottom, mounting and tightening the holding fixture, removing the pulling handle, pre-stressed blade ready for installation.

Figure 10: Removing the pre-stressed blade from bending fixture.


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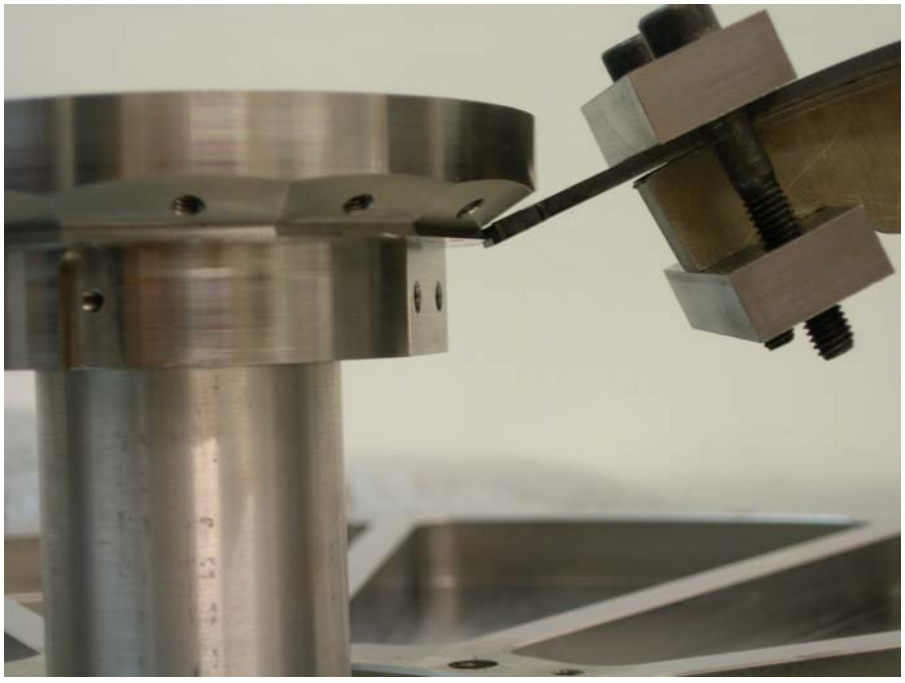

Figure 11: Top to bottom, presenting the pre-stressed blade into the keystone, which is held in place by the holding column, note in the second image the small angle between the blade's tip and the keystone, that will disappear as the blade is released, two opposite blades are mounted at the same time to null transverse stress., the blade is tyed to the keystone with a retaining screw.

Figure 12: Top, the holder clamp is removed from the tip of the two opposite blades. Bottom, The bending arch is released from the blade clamp and removed. The blade's tip holding screw is then tightened.

Figure 13: After all the required blades are mounted against the keystone (four in this case), the keystone end-stop ring is assembled.

Figure 14: The stress is transferred to the keystone end stop ring and locked at the desired height using the custom coaxial tool.

Figure 15, the keystone holding column is removed. At this point a real payload could be hung from the keystone.

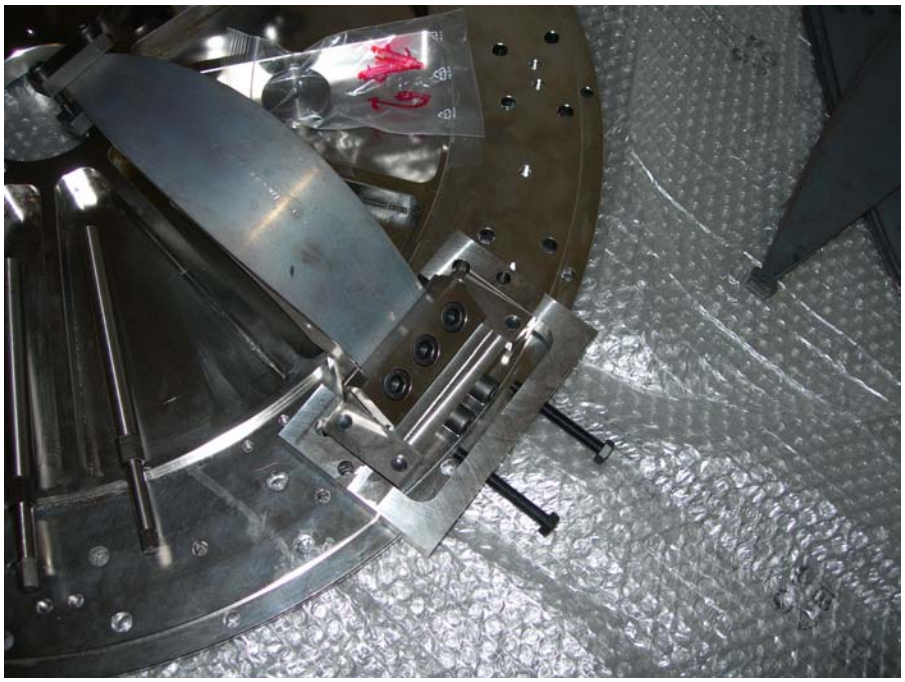

Figure 16. If a payload had been hung on the keystone, the resonant frequency of the filter could be tuned with the tuning horse shoe.

Figure 17: Top to bottom, the wire suspension nose is mounted in the filter shell, the filter mounted inside the shell and bolted closed.